Preface

The information age has enabled unprecedented levels of data to be collected and stored. Consequently, decisions in many facets of human endeavour have become increasingly complex. In a parallel development, decision making is rarely left in the discretionary hands of a single body but is increasingly performed by groups, often not meeting at the same time or in the same place, but always pursuing consultative and often deliberative dialogues toward a decision. These changes result in the emergence of one of the major challenges of the modern era: ensuring that technologies develop to support collaborative reasoning.

It seems unimaginable that information and communication technologies continue to transform the reasoning landscape without some direct contribution to supporting the reasoning process. This book, *Technologies for Supporting Reasoning Communities and Collaborative Decision Making: Cooperative Approaches* includes chapters from diverse fields of enquiry including political science, argumentation, knowledge management, cognitive psychology and business intelligence. Each chapter illustrates a perspective on group reasoning that ultimately leads to a greater understanding of reasoning communities and inform technological developments.

Understanding Collaborative Reasoning

In order to enhance technological support for collaborative reasoning, more must be understood about the underlying processes that occur when groups reason. The first six chapters describe diverse conceptual perspectives on group reasoning.

In the first chapter, *An Argumentation Model of Deliberative Decision-Making*, Doug Walton identifies deliberation as a pivotal type of dialogue for group reasoning. Deliberative dialogues, in contrast to the more combative persuasion dialogues, have not been extensively studied in argumentation theories. He presents a model of deliberative argumentation using a readily accessible example and suggests that computer support systems based on this kind of model are clearly feasible.

As a political scientist, Simon Niemeyer is concerned with understanding collaborative reasoning for the purpose of advancing democracies by enabling greater direct citizen participation in policy generation. The realisation that Habermasian communicative action idealises deliberation in a way that is too prescriptive for practical application led Niemeyer to two conceptual advances: meta-consensus and intersubjective rationality. Meta-consensus describes the process a group undergoes to achieve agreement on the factors that are relevant in the discussion without agreeing on facts or outcomes. Meta-consensus contextualises and places boundaries on the reasoning. Inter-subjective rationality draws on meta-consensus and provides a much needed mechanism to measure the progress a group is making toward rational decisions.
Insights into collaborative reasoning in groups have emerged from studies comparing face to face groups with computer mediated groups. In *Communication and Group Performance: Comparing CMC with FTF Decision-making Groups in Taiwan*, Shu-Chu Sarrina Li, Lin-Mei Huang, & Yi-Ching Liu present a comparative study in order to illustrate how the two groups operate quite differently. Media richness theories advocate the use of face to face meetings with problem solving tasks that are complex and highly ambiguous and leaner media such as email when the problem solving tasks are less ambiguous. Li and her colleagues use empirical studies to report on group solutions to a hypothetical complex problem by positing that some parts of the outcome could be objectively rated. The aim was to identify the factors critical for effective group reasoning in face to face and computer mediated groups. They found that problem analysis, generating alternatives, and assessment of positive and negative consequences were critical. Face to face groups performed these tasks better than the virtual groups, thereby confirming the media rich theories. However, contrary to previous studies, elements such as social talk, not directly related to the problem, was found to play an important role in group outcomes.

Another insight from face to face and computer mediated studies involves the sharing of private information. Jamonn Campbell’s *Information Sharing and Processing in Computer Mediated Interactions*, examines collective information sharing—the tendency to use shared information rather than private information. Evidence from face to face groups has demonstrated that participants face many barriers to sharing all of their information. Some of the barriers seem to be overcome in computer mediated groups; however, a survey of the literature reveals information sharing is less than optimal in either forum. Campbell puts forward a strong case for the discovery of optimal ways to integrate face to face communication with computer mediated communications.

Celina Olszak and Ewa Ziemba’s chapter, *Communities of Practice in Knowledge Management and Organisational Learning* presents a comprehensive study on communities of practice in Poland. They discover that despite some awareness of the benefits of communities of practice, their use in practice is in fact quite limited. The empirical findings are contrasted against a theoretical perspective drawn from Nonaka’s conceptualisation of organisational growth through knowledge evolution.

The perspective we bring to the field of collaborative reasoning in the final chapter of the section, *A Reasoning Community Perspective on Deliberative Democracy*, derives from earlier work in computational modeling of reasoning using argumentation and narrative theories. Conceiving of a group as a community that is comprised of participants connected by their need to reason toward a course of action, enables the specification of high level phases the community performs. The phases—engagement, individual reasoning and group coalescing—iterate until the ultimate decision making phase is performed. Adopting this view enables an understanding of group reasoning that facilitates the identification of technological support at each phase.

### Enhancing Collaborative Reasoning

The second group of chapters focuses more heavily on advancing approaches that directly enhance group reasoning. Like the chapters in the previous section, they derive from very diverse fields of inquiry. The influential Analytical Hierarchy Process that Tom Saaty advanced some years ago enables a group to identify criteria that are prominent in decision making. In his chapter, *Group Decision Making: How to Obtain Representative Group Judgments from Individual Judgments*, Saaty discusses issues that arise when some criteria are tangible and easily measured and others are not so tangible yet quite important and presents a way to integrate intangible with tangible scales. The approach is elegantly illustrated with a case study involving a hospice decision.
Taemie Kim and Alex Pentland’s aim to support group deliberations with the direct use of electronic devices in meetings presents an innovative contrast to other approaches. Their chapter, *Distributed Collaborations and the Effect of Sociometric Feedback* introduces the use of location, sound and video devices that provide feedback to participants about the discussion. Information such as the duration of each participant’s contributions and the frequency of exchanges between each pair of participants does help face to face and computer mediated groups identify and correct communicative imbalances.

A key element of any group reasoning exercise involves the integration of diverse and often conflicting views that occur in many group reasoning endeavours. Numerous approaches have been advanced, but most do not derive from the formalism of mathematical theory. In the next chapter, *Methods of Aggregation of Experts’ Opinions*, Jiří Vaníček, Ivan Vrana and Shady Aly present an approach for integrating diverse positions that is based on fuzzy set theory. The fuzzy set based approach enables the representation of uncertainty that is required while still retaining some mathematical rigor.

The central assumption that Marco Castellani makes, in drawing on George Kelly’s cognitive theory of personal constructs for his chapter *Cognitive Tools for Group Decision Making: the Repertory Grid Approach Revisited*, is that the full context of reasoning is required to understand a group’s reasoning. He includes a case study illustrating how a world view can be elicited from group participants using the repertory grid technique from cognitive psychology. Without this approach, he argues, issues that arise as important for decision making may not be the most pressing for resolution. Solutions are premature or inappropriate, and an opportunity for deeper understanding of the context is lost to participants.

Cengiz Kahraman, Selcuk Cebi and Ihsan Kaya advance a mathematical approach for determining which computer assisted manufacturing technologies are best deployed for a given problem. This task becomes very cumbersome for Analytical Hierarchy Process because there are so many configuration options that the pairwise comparisons of each elements becomes difficult to perform and interpret. Further, many criteria in practice are not independent from each other even though most multi-criteria decision models assume independence. In their chapter, *Group Decision Making For Advanced Manufacturing Technology Selection Using Choquet Integral*, Kahraman and his colleagues use a method known as the Choquet integral that measures the expected utility of an uncertain event. Based on fuzzy set theory, the Choquet Integral can represent interactions between criteria so that they can be taken into account in solving multi criteria decision equations.

Erich Schweighofer focuses on legal reasoning and surveys three decades of research aimed at automating reasoning in law, concluding that most attempts have been far from successful. In his chapter, *Indexing as an Ontological-based Support for Legal Reasoning*, Schweighofer identifies the role ontologies play in directing information retrieval technologies in law. Ontologies represent agreement by the community on core concepts and their inter-relationships. As such, they provide important components of the infrastructure for individual and group reasoning. The role ontologies play in multilingual legal retrieval and indexing huge legal corpora attest to this.

In our chapter, *A Case for the Re-Use of Community Reasoning*, we argue that evidence is mixed that argument visualisation enhances a group’s reasoning, deliberations or decisions. However, the case is made that argument visualisation enables a community to re-use the reasoning arrived at by another community. Benefits are achieved over time as the argument visualisation permits greater transparency and re-use of reasoning.

Many initiatives toward enhancing group reasoning have been performed to date in diverse application areas. Insights from application areas can be categorised into two groups; those that seek to enhance or understand group reasoning in real world communities, and those that seek to enhance or understand group reasoning in virtual communities. The next chapters relate to group reasoning in the real world.
Collaborative Reasoning in the Real World

Significant insight into collaborative reasoning can be gleaned from the experiences in understanding how collaborative reasoning actually occurs in real world groups, and how challenges in developing technologies to support the reasoning have been tackled. This group of chapters presents contributions from a variety of real world applications in diverse industries.

In the realm of commerce, Jesus Gonzalez-Feliu and Joëlle Morana in France explore the role that information sharing has on the collective decisions made in supply chain management. In their chapter, Collabo rative transportation sharing: from theory to practice via a case study from France, they identify that information sharing is the critical factor in reasoning that occurs as stakeholders along the supply chain collaboratively make decisions. However, a shared conceptual model is required for determining what information must be shared. The model they advance identifies six kinds of information related to supply chain enterprises: an enterprise’s solutions, their deals, sharing management, organizational features, technological features and information related to the management of shared information. They illustrate the applicability of their model with a case study related to the distribution of newspapers in France.

Dino Borri and Domenico Camarda in their chapter on Spatial Ontologies in Multi-Agent Environmental Planning make the case that the kind of reasoning task is fundamentally important. They look at a kind of collaborative reasoning often overlooked: reasoning used to navigate through physical space. In one study, they explore the relationship individuals have with their immediate environment in different localities throughout Europe. In a related study they explore the elements that are important when students navigate through a building to find a room. They identify the need for an ontology of concepts related to that task, particularly if intelligent systems are to support or emulate the task.

In Chewing the Communal Cud: Community Deliberation in Broadsheet Letters and Political Blogs, Jane Mummery and Debbie Rodan identify an imperative for appropriate forums for community deliberation. They examine two forums—newspaper Letters to the Editor and political internet blogs—and contend that open airing of views is the critical element in collaborative reasoning, even if the nature of dialogue or representativeness of the participants does not meet theoretical ideals. In a kind of “just do it” stance the authors advocate that accessibility to forums sets community deliberations in place.

In their chapter, Emilia Bellucci and John Zeleznikow provide an illustration of how technologies can support reasoning when participants are in dispute. The survey of negotiation support systems demonstrate that effective systems can be developed based on heuristics of principled negotiation. They present two systems in family law disputes, FamilyWinner and AssetDivider that implement principled negotiation heuristics in different ways. It is ironic that the development of systems that facilitate the resolution of disputes can provide invaluable insights into the collaborative reasoning process.

In Supporting Communities of Practice by Advancing Knowledge Management between Hybrid Collaborative Environments, De Liddo and Concilio describe the integration of two types of tools to support collaborative decision making communities. One tool, Compendium derives from knowledge management principles while the other CoPe_it!, derives from argumentation concepts. The case study presented illustrates the effectiveness of their approach in a real world setting.
Collaborative Reasoning in the Virtual World

The World Wide Web was once seen as an information repository and resource. However, more recently, it acts as a communication medium and as a forum for the liberal exchange of information and personal expression. As such, it has considerable potential for supporting group reasoning and decision-making. Key considerations needed to move towards implementations of systems to support collaborative reasoning in virtual worlds include a greater understanding of the nature of virtual communities, their differences and similarities with real world communities, the nature of reasoning tasks in both spheres, and the limitations of both. The next group of chapters discusses issues related to collaborative reasoning within or about a virtual world.

Vanessa Dennen looks closely at group reasoning in blogs and particularly focus on two aspects of behaviour in groups, the propensity individuals have to share knowledge and the extent to which bloggers are prepared to encourage, empathise and provide support to other bloggers. By looking at posts to a single and multiple blogs, she discerned problems that relate uniquely to the individual or are shared by others. Each type of problem is empirically shown to have distinct norms, roles, and individual ownership prescriptions.

Andrei Kelarev, Simon Brown, Paul Watters, Xinwen Wu and Richard Dazeley examine the way in which features of the problem informs group reasoning. In their focus on internet security response, a decision, taken by an organisation, government or sector about how to respond to a cyber-attack differs from many other decisions in that it must be made quickly, on the basis of very little clear information, and where the consequences of failing to respond appropriately may be devastating. In their chapter, *Establishing Reasoning Communities of Security Experts for Internet Commerce Security*, they compare and contrast the use of a number of techniques to facilitate group reasoning including Brainstorming, Reverse brainstorming, Delphi, Wide Delphi and Generic Actual Argument Model for that task and suggest the task environment is particularly well suited to the Delphi approaches.

Charlynn Miller and Philip Smith in *Web Technologies and Reasoning Communities* align Web 2.0 and emerging Web 3.0 technologies to engagement, individual reasoning, group coalescing and decision making phases of reasoning communities. The comprehensive survey of social networking and collaborative work applications available on the web demonstrate, in a fitting conclusion to the book, that practice is not waiting for theory in the collaborative reasoning realm.

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